



National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material[®] 2737

Nitric Oxide in Nitrogen Total Oxides of Nitrogen in Nitrogen

(Nominal Amount-of-Substance Fraction – 500 nmol/mol)

This certificate reports the certified value for Lot 2737-AL-XX.

This Standard Reference Material (SRM) is a primary gas mixture that, the amount-of-substance fraction expressed as concentration [1], may be related to secondary working standards. The SRM is intended for the calibration of instruments used for nitric oxide determinations and for monitoring source emissions, and combustion process streams.

This SRM mixture is supplied in a DOT 3AL specification aluminum (6061 alloy) cylinder with a water volume of 30 L. Mixtures are shipped with a nominal pressure exceeding 12.4 MPa (1800 psi), which provides the user with 3.65 m³ (125.8 ft³) of useable mixture. The cylinder is the property of the purchaser and is equipped with a CGA-660 stainless steel valve, which is the recommended outlet for this nitric oxide mixture. NIST recommends that this cylinder **NOT** be used below 0.7 MPa (100 psi).

Certified Value: This SRM mixture has been certified for nitric oxide (NO) and total oxides of nitrogen (NO_x) concentration. The certified values, which apply to the identified cylinder and NIST sample number, are given in Table 1 on page 3 of this certificate.

The uncertainty of the certified value includes the estimated uncertainties in the NIST standards, the analytical comparisons to the lot standard (LS), and the uncertainty of comparing the LS with each of the gas mixtures comprising this lot. The uncertainty is expressed as an expanded uncertainty, $U = ku_c$, with u_c determined from experiment and a coverage factor $k = 2$. The true value for the Nitric Oxide and Total Oxides of Nitrogen amount-of-substance fractions is asserted to lie in the interval defined by the certified value $\pm U$ with a level of confidence of approximately 95 % [2].

Expiration of Certification: For expiration date (see Table 1). NIST will monitor this SRM over the period of its certification. If changes occur that affect the certification before the expiration of this certificate, NIST will notify the purchaser. Registration (see attached sheet) will facilitate notification.

Cylinder and Gas Handling Information: NIST recommends the use of a high-purity, stainless steel, two-stage pressure regulator with a stainless steel diaphragm and CGA-660 outlet to safely reduce the pressure and to deliver this SRM mixture to the instrument. The regulator should be purged several times to prevent accidental contamination of the sample.

The analytical measurements leading to the certification of this SRM lot were performed by W.J. Thorn III of the NIST Analytical Chemistry Division.

The overall direction and coordination of the technical work for required for certification of this SRM lot was performed by F.R. Guenther of the NIST Analytical Chemistry Division.

Statistical evaluation of the data was performed by S.D. Leigh of the NIST Statistical Engineering Division.

Stephen A. Wise, Chief
Analytical Chemistry Division

Gaithersburg, MD 20899
Certificate Issue Date: 26 January 2006

Robert L. Watters, Chief
Measurement Services Division

The support aspects involved in the issuance of this SRM were coordinated through the NIST Measurement Services Division.

Mixture Preparation: The gas mixtures comprising this SRM lot were prepared in accordance with NIST technical specifications by a commercial specialty gas vendor. NIST acknowledges that this SRM was made possible through the donation of the candidate gas mixtures by the American Industry/Government Emissions Research (AIGER)¹ consortium.

Analytical Methods: Analyses of the nitric oxide and total oxides of nitrogen concentrations for this lot of cylinders were conducted by comparing each cylinder mixture to a representative cylinder chosen from the lot, the lot standard (LS), using chemiluminescence. Assignment of the nitric oxide and total oxides of nitrogen concentrations to the LS was accomplished by comparison to NIST working standards using chemiluminescence. The NIST working standards were value assigned using two independent methods. The first method used was dilution of permeating nitrogen dioxide from a permeation tube, with a known flow of nitrogen. The second method used was dynamic dilution of a higher concentration nitric oxide primary standard.

Homogeneity Analysis: Each of the nitric oxide mixtures, which comprise this SRM lot, was compared to the LS using chemiluminescence. An analysis of variance indicated that sample-to-sample nitric oxide concentration differences were statistically significant. Therefore, each cylinder in the lot of SRM 2737 has been individually assigned a certified concentration. Use only the values that were issued for the cylinder identified on the first page of this certificate.

Nitric Oxide and Total Oxides of Nitrogen Concentration Value Assignment: The certified nitric oxide and total oxides of nitrogen concentrations for this SRM lot were computed from the assigned concentration for the lot standard and the homogeneity analysis.

Stability: Periodic analyses of SRM units from this lot are performed at NIST to monitor stability. The NO and NO_x concentration of this SRM is expected to increase over time. The certified value has been adjusted to a value expected at half the certification period, and the uncertainty increased to account for this extrapolation. This SRM must be recertified at NIST in order to continue using the SRM past the original expiration date. Please return the cylinder to NIST for recertification. A nominal fee will be required for this service.

REFERENCES

- [1] Taylor, B.N.; *Guide for the Use of the International System of Units (SI)*; NIST Special Publication 811; U.S. Government Printing Office: Washington, DC (1995).
- [2] ISO; *Guide to the Expression of Uncertainty in Measurement*; ISBN 92-67-10188-9, 1st ed.; International Organization for Standardization: Geneva, Switzerland (1993); see also Taylor, B.N.; Kuyatt, C.E.; *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*; NIST Technical Note 1297; U.S. Government Printing Office: Washington, DC (1994); available at <http://physics.nist.gov/Pubs/>.

Users of this SRM should ensure that the certificate in their possession is current. This can be accomplished by contacting the SRM Program at: telephone (301) 975-6776; fax (301) 926-4751; e-mail srminfo@nist.gov; or via the Internet at <http://www.nist.gov/srm>.

¹ Certain commercial equipment, instruments, or materials are identified in this certificate to adequately specify the experimental procedure. Such identification does not imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the materials or equipment identified are necessarily the best available for the purpose.

Expiration of Certification: This certification is valid until **31 October 2007**, within the measurement uncertainties specified, provided the SRM is handled and stored in accordance with the instructions given in this certificate. However, the certification will be nullified if the SRM is contaminated or modified.

Table 1. Cylinder Information and Certified Values

Cylinder Number:

NIST Sample Number:

Hydrotest Date:

Blend Date:

Nitric Oxide (NO) Concentration:	nmol/mol \pm 15 nmol/mol
Total Oxides of Nitrogen (NO _x) Concentration:	nmol/mol \pm 15 nmol/mol